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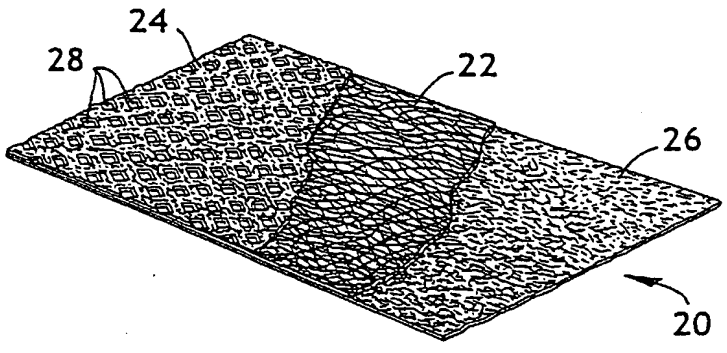

(57) Abstract: Multicomponent fiber nonwoven webs having excellent liquid handling and/or repellency properties are described wherein the multicomponent thermoplastic polymer fibers have exposed first and second components that form the outer surface of the multicomponent fibers and that extend substantially continuously along the length of the fibers. The first component comprises a thermoplastic polymer and an active agent, such as a liquid repellency agent, and the second component comprises a thermoplastic polymer and contains from 100% to 50% by weight less active agent than the first component.

WO 02/09491 A2

FABRICS HAVING MODIFIED SURFACE PROPERTIES

Field of the Invention

The present invention relates to fabrics having modified surface properties and, more particularly, fabrics having improved liquid barrier and/or repellency properties.

Background of the Invention

It is known in the art that the physical properties of fabrics can be modified by the application of one or more chemical compositions thereto. As but a few examples, fabrics have heretofore been treated with various chemical compositions in order to improve and/or impart the following properties to fabrics: strength, wettability, absorbency, anti-static (static decay), flame retardancy, alcohol repellency, etc. The chemical compositions are commonly applied in such a manner so as to modify the surface properties of the fibers comprising the fabric. In this regard, it is often desirable for the chemical composition to be applied throughout the thickness of the fabric. By applying the chemical composition in such a manner the desired physical properties can be imparted to the entire fabric and not just the outer portions of the same. This can greatly increase the desired properties of the treated fabric and/or increase the efficacy of the treatment. However, the ability to uniformly apply a topical treatment throughout the thickness of thick and/or fine fiber substrates is difficult. Existing methods for topically applying chemical compositions often fail to provide a method by which the compositions are uniformly applied throughout the thickness of the fabric in an efficient, cost-effective manner.

As an example, active agents have heretofore been applied to fabrics by applying the chemical composition to one surface of the fabric and then applying a vacuum to the opposite surface of the fabric. The drawing force of the vacuum is intended to help pull the active agent into the fabric and treat the fibers within the interior of the fabric. By way of example only, topically coating fiber surfaces with chemical compositions is generally described in US Patent No. 4,266,976 to Gregorian et al. and US Patent No. 4,385,954 to Pauls et al. Another method of treating fabrics with an active agent is through complete sheet saturation. One such method is a "dip and squeeze" method whereby a fabric is first completely immersed in a bath of the active agent and thereafter the fabric is run through a pair of compaction rollers which act to "squeeze" or compress the fabric in order to remove excess amounts of the active agent. This and other like processes are

generally described in European Patent No. 0472942. However, such processes can generate undesirable amounts of waste since significant amounts of the chemical composition are often removed from the fabric. In addition, for tightly formed fabrics and/or thicker fabrics, such processes often fail to create a web that is uniformly treated and can also degrade the desired physical properties of the fabric. Still further, such processes can also leave an excessive amount of the treatments on the outer surface of the fabric that, with many chemical compositions, can promote transfer of the chemical composition to adjacent surfaces and give the fabric an oily feel. This is highly undesirable for fabrics that will be handled and/or be utilized in an article adjacent a persons skin. Still further, such non-uniform treatment may require the use of higher levels of active agent to achieve the desired physical properties.

In addition to the topical treatment of fibers, surfactants and other active agents have been included in the polymer that is to be melt-processed. By way of example only, US Patent Nos. 3,973,068 and 4,070,218 to Weber teach a method of mixing a surfactant with the polymer and then melt-processing the mixture to form the desired fabric. The fabric is then treated in order to force the surfactant to the surface of the fibers. This is often done by heating the web on a series of heated rolls and is often referred to as "blooming." As a further example, US Patent No. 4,578,414 to Sawyer et al. describes wettable olefin polymer fibers formed from a composition comprising a polyolefin and one or more surface-active agents. The surface-active agents are stated to bloom to the fiber surfaces where at least one of the surface-active agents remains partially embedded in the polymer matrix. In this regard, the permanence of wettability can be better controlled through the composition and concentration of the additive package. Still further, US Patent No. 4,923,914 to Nohr et al. teaches a surface-segregatable, melt-extrudable thermoplastic composition suitable for processing by melt extrusion to form a fiber or film having a differential, increasing concentration of an additive from the center of the fiber or film to the surface thereof. The differential, increasing concentration imparts the desired characteristic, e.g. hydrophilicity, to the surface of the fiber. As a particular example in Nohr, polyolefin fiber nonwoven webs are provided having improved wettability utilizing various polysiloxanes.

While various methods are known in the art for improving or modifying the surface characteristics of polymeric fibers, their remains a continuing need for providing fabrics with the desired physical properties that can be made more efficiently and/or economically. This is particularly true where the products are intended to be used as or within disposal articles such as, for example, wipes, sorbents, medical fabrics, personal care products and so forth.

Summary of the Inv ntion

The aforesaid needs are satisfied and/or the shortcomings of the prior art overcome by a nonwoven fabric of the present invention comprising a web of multicomponent thermoplastic polymer fibers having at least one component A and at least one component B arranged in substantially distinct zones across the fiber cross-section and extending substantially continuously along the length of the fibers wherein the components A and B each have exposed portions forming the outer surface of the multicomponent fibers. The exposed portion or portions of component A comprise at least about 25% of the peripheral surface of the fibers. In addition, component A comprises a thermoplastic polymer and an active agent and has active agent upon the exposed portion thereof. Component B comprises a thermoplastic polymer and contains from 100% to 50% by weight less active agent than component A.

In a particular aspect, component A comprises at least about 50% of the outer surface of the multicomponent fibers. As an example of a suitable cross-sectional configuration, component A can comprise at least two discrete components separated by one or more B components. In a further aspect, the multicomponent fibers desirably have an average fiber diameter less than about 25 micrometers and, more desirably, have an average fiber diameter less than about 10 micrometers. As examples, the active agent can comprise wetting agents or liquid repellency agents. Additionally, desirably no single or continuous exposed portions of component B comprise more than about 35% of the peripheral surface of the multicomponent fiber. In a further aspect, component B desirably comprises at least about 45%, by volume, of the fiber cross-section. Further, nonwoven fabrics having good liquid barrier and/or repellency properties can be provided wherein the active agent comprises a liquid repellency agent and the multicomponent fibers have an average denier less than about 1. In addition, the active agent may comprise less than 0.75%, by weight, of the multicomponent fibers and the nonwoven web may also have a basis weight less than about 50 g/m^2. Despite having relatively low basis weights, such nonwoven fabrics can be provided having an alcohol repellency rating of 50 or more.

Brief Description of the Drawings

Figure 1 is a drawing illustrating the cross-section of a multicomponent fiber, suitable for use with the present invention, having polymeric components A and B in a striped configuration.

Figure 2 is a drawing illustrating the cross-section of a multicomponent fiber, suitable for use with the present invention, with the polymer components A and B in a wedge configuration.

Figure 3 is a drawing illustrating the cross-section of a multicomponent fiber, suitable for use with the present invention, with the polymer components A and B in a configuration wherein a plurality of wedge-like components are separated by a central component having radially extending arms.

Figure 4 is a partially broken-away view of a multilayer nonwoven laminate incorporating a meltblown fiber web comprising multicomponent fibers.

Definitions

As used herein and in the claims, the term "comprising" is inclusive or open-ended and does not exclude additional unrecited elements, compositional components, or method steps. Accordingly, the term "comprising" encompasses the more restrictive terms "consisting essentially of" and "consisting of."

As used herein, all percentages, ratios and proportions are by weight unless otherwise specified.

As used herein the term "active agent" refers to any chemical compound or composition that imparts or improves at least one physical property or functional characteristic of a fiber surface.

As used herein the term "wetting agent" refers to any chemical compound or composition that makes a fiber surface exhibit increased hydrophilic characteristics such as by lowering the contact angle of an aqueous fluid that comes in contact with the fiber surface.

As used herein the term "liquid repellency agent" refers to any chemical compound or composition that makes a fiber surface exhibit increased barrier or repellency characteristics for a particular liquid such as by increasing the contact angle for the particular liquid that comes in contact with the fiber surface.

As used herein the term "fabric" means a material comprising a network of fibers including, but not limited to, woven or knitted materials, tufted or tufted-like materials, nonwoven webs, and so forth.

As used herein the term "nonwoven" fabric or web means a web having a structure of individual fibers or threads which are interlaid, but not in an identifiable manner as in a knitted or woven fabric. Nonwoven fabrics or webs have been formed by many processes such as, for example, meltblowing processes, spunbonding processes, hydroentangling, air-laid and bonded carded web processes.

As used herein the term "polymer" generally includes but is not limited to, homopolymers, copolymers, such as for example, block, graft, random and alternating copolymers, terpolymers, etc. and blends and modifications thereof. Furthermore, unless otherwise specifically limited, the term "polymer" includes all possible geometric or spatial configurations of the molecule. These configurations include, but are not limited to isotactic, syndiotactic and random symmetries.

As used herein, the term "medical fabric" means medically oriented items such as surgical gowns and drapes, face masks, bouffant caps, surgical caps and hoods, shoe coverings, slippers, wound dressings, bandages, sterilization wraps, wipers, garments like lab coats, coveralls, aprons and jackets, patient bedding, and so forth.

As used herein, the term "personal care product" means personal hygiene oriented items such as wipes, diapers, training pants, absorbent underpants, adult incontinence products, feminine hygiene products, and so forth.

As used herein, the term "protective cover" means a cover for vehicles, covers for outdoor equipment and furniture, yard and garden equipment, floor coverings, table cloths, tents, tarpaulins, and so forth.

Detailed Description of the Invention

Fabrics of the present invention comprise an integrated layer or sheet of multicomponent fibers having at least two components and wherein the surface properties of the fibers are modified by an active agent primarily located within less than all of the components. The term "multicomponent" refers to fibers that have been formed from at least two polymer streams and extruded to form a unitary fiber. The individual components of a multicomponent fiber are arranged in distinct regions in the fiber cross-section, which extend substantially continuously along the length of the fiber. The cross-sectional configuration of the multicomponent fibers has at least two distinct components that comprise a portion of the outer surface of the fiber. Desirably, the multicomponent fiber has three, four or more exposed segments forming the outer surface of the fiber. As indicated above, the segments of the individual polymeric components collectively form the outer surface of the multicomponent fiber. The multicomponent fiber comprises at least first and second components wherein the second component comprises significantly less active agent than the first component. Desirably the second component comprises at least about 50% (by weight) less active agent than the first component and still more desirably comprises at least about 75% less active agent than the first component and still further may comprise about 95% less active agent than the first component. In a further aspect,

the second component may have 100% less active agent than the first component, i.e. zero weight percent active agent therein.

As a specific example and in reference to FIG. 1, the individual components of the fiber can be positioned in a striped, side-by-side arrangement wherein the individual components A and B are adjacent one another and each component occupies at least a portion of the periphery or outer surface of the fiber. As a further example and in reference to FIG. 2, wedge or "pie" shaped configurations comprising alternating wedge shaped segments A and B are also suitable for use in connection with the present invention. As yet a further example and in reference to FIG. 3, a plurality of components A can be separated by a central B component having radial extending arms or lobes. When using only two polymer compositions to form the individual components of the multicomponent fibers, the respective polymer components A and B can be present in ratios (by volume) of from about 90/10 to about 10/90 and desirably range between about 75/25 and about 25/75. Ratios of approximately 50/50 are often particularly desirable however the particular ratios employed can vary as desired.

In addition, the individual components of the multicomponent fibers are arranged in the fiber cross-section such that the component(s) having a minor amount or lacking the internal active agent comprises no more than about 70% of the periphery or outer surface of the fiber. Desirably, the component(s) containing the major amount of active agent comprise greater than 30% of the outer surface of the fiber and still more desirably at least about 50% of the outer surface of the fiber and even more desirably between about 55% and about 85% of the outer surface of the fiber. In addition, with regard to fabrics having improved barrier and/or liquid repellency properties, the exposed segments of component(s) having a minor amount of or lacking the internal active agent desirably do not form a single or continuous segment greater than about 35% of the outer surface of the fiber and still more desirably do not form a single or continuous exposed segment extending over about 25% of the outer surface of the fiber. As a specific example, with reference to the striped cross-sectional configuration depicted in FIG. 1, component B may comprise approximately 50% by volume of the fiber and yet the two, discrete exposed portions each comprise approximately 10-15% of the outer surface of the multicomponent fiber. As a further specific example, with reference to FIG. 2, while the exposed segments of the B components may collectively comprise approximately 50% of the outer surface of the multicomponent fiber, the exposed segments or portions each comprise only about 12.5% of the outer surface of the fiber.

The fibers desirably have a denier (g/9000 meters) of less than about 4 and still more desirably less than about 1 and even more desirably less than about 0.5. In a further

aspect, the fibers can have an average cross-sectional diameter of less than about 25 micrometers and desirably have an average cross-sectional diameter between about 0.5 micrometers and about 10 micrometers and still more desirably between about 1 and about 5 micrometers. As used herein, average fiber size is determined using the largest dimension in the fiber cross-section. While fibers are commonly manufactured as solid-round structures it will be appreciated that the multicomponent fibers of the present invention can also have various fiber shapes other than solid-round fibers such as, for example, hollow, multilobal or flat (e.g. ribbon shaped) fibers.

The components forming the fibers can comprise one or more melt-processable polymers. The individual components can comprise the same, similar and/or different polymers. However, at least two of the individual components are distinct in that they have selected and distinct amounts of active agent therein. The polymeric components of the multicomponent fibers are desirably selected from thermoplastic polymers including, but are not limited to, polyolefins (e.g., polypropylene and polyethylene), polycondensates (e.g., polyamides, polyesters, polycarbonates, and polyarylates), polyols, polydienes, polyurethanes, polyethers, polyacrylates, polyacetals, polyimides, cellulose esters, polystyrenes and so forth. As particular examples, the polymeric components can comprise polyethylene, polypropylene, poly(1-butene), poly(2-butene), poly(1-pentene), poly(2-pentene), poly(1-methyl-1-pentene), poly(3-methyl-1-pentene), and poly(4-methyl-1-pentene) and so forth. In addition, blends and/or copolymers of the aforesaid polymers are likewise suitable for use in one or more components of the multicomponent fiber. The individual components or segments comprising the multicomponent fiber can comprise the same polymer or different polymers. By way of example only, desired combinations of polymer segments can comprise polyolefin/polyamide; polyolefin/polyester; polyolefin/polyolefin and so forth. More particularly, examples of suitable polymeric component combinations include, but are not limited to, polypropylene/polyethylene, polypropylene/polypropylene, polyethylene/nylon, polyethylene/polyester and so forth. As a specific example and in reference to FIGS. 1 and 2, components A can comprise a mixture of a propylene polymer and an active agent and component(s) B can comprise a propylene polymer. As a further specific example, components A can comprise an active agent and a blend of polypropylene and polybutylene and component(s) B can comprise polypropylene. Still further, components A can comprise an active agent and polypropylene and component(s) B can comprise a blend of polypropylene and polybutylene. Exemplary polypropylene and polybutylene blends include, but not limited to, those described in US Patent Nos. 5,204,174 and 5,482,765.

The fibers comprising the fabric can be made by various melt-processing techniques. Generally, multicomponent fibers can be made by simultaneously directing two or more streams of molten polymer such that the polymer streams come together to form a unitary filament immediately prior to or just after extruding the polymers from a die or other extrusion device. The polymers are desirably fed to the die via separate conduits and kept separate until just prior to extrusion. In a further aspect, a divider plate can be utilized to maintain the separation of the polymer streams up to and until the polymer reaches the die capillary. Additionally, multicomponent fibers can be made utilizing spin pack assemblies. Generally described, a spin pack assembly can include a housing and a plurality of distribution plates stacked one on top of the other with a pattern of openings arranged to create flow paths for directing polymer components A and B separately through the spin pack assembly. The distribution plates are coupled to a spin plate or spinneret which often has a plurality of openings arranged in one or more rows. Exemplary methods and apparatus for making multicomponent nonwoven webs are described in US Patent No. 3,425,091 to Ueda et al., US Patent No. 3,981,650 to Page, US Patent No. 5,601,851 to Terakawa et al., US Patent No. 5,989,004 to Cook, US Patent No. 5,344,297 to Hills and US Patent No. 5,382,400 to Pike et al.

Fibers and/or fabrics of the present invention can be made using conventional melt-processing equipment modified to form multicomponent fibers. Exemplary fiber forming processes include, but are not limited to, meltblown and spunbond processes. The fibers can be substantially continuous fibers or short, i.e. staple length, fibers. As a specific example, fibers and fabrics of the present invention can be made using meltblown fiber equipment. Accordingly, multicomponent meltblown fiber nonwoven webs can be made in accord with meltblowing processes such as, for example, those described in US Patent 3,849,241 to Butin et al.; US Patent No. 5,160,746 to Dodge et al.; US Patent No. 4,526,733 to Lau; US Patent No. 5,652,048 to Haynes et al.; US Patent No. 5,366,793 to Fitts et al. and Naval Research Laboratory Report No. 4364 entitled "Manufacture of Superfine Organic Fibers" by V. Wente, E. Boone and C. Fluharty; the entire contents of the aforesaid references are incorporated herein by reference. When using conventional meltblowing apparatus the primary or attenuating air will often have a temperature above the melting point of each of the polymers comprising the individual polymeric components. However, the primary or attenuating air can, optionally, have a temperature at or below the melting point of one or more of the extruded polymers. Detailed description of apparatus and methods suitable for forming meltblown fiber webs using cool air is described in US Patent Application Serial No. 08/994,373 filed December 19, 1997 to Haynes et al., the entire contents of which is incorporated herein by reference. In addition, as indicated

above, multicomponent spunbond fiber nonwoven webs can be made using conventional melt-spinning equipment as well. In this regard and by way of example only, spunbond fiber nonwoven webs and processes of making the same are described in US Patent No. 4,340,563 to Appel et al.; US Patent No. 3,692,618 to Dorschner et al.; US Patent No. 3,802,817 to Matsuki et al.; US Patent No. 3,502,763 to Hartman; US Patent No. 3,542,615 to Dobo et al.; and US Patent No. 5,382,400 to Pike et al., the entire contents of which are incorporated herein by reference.

The particular active agent or agents included within one or more of the components can be selected as desired to impart or improve specific surface characteristics of the fiber and thereby modify the properties of the fabric made therefrom. A variety of active agents or chemical compounds have heretofore been utilized to impart or improve various surface properties including, but not limited to, absorbency, wettability, anti-static properties, anti-microbial properties, anti-fungal properties, liquid repellency (e.g. alcohol or water) and so forth. With regard to the wettability or absorbency of a particular fabric, many fabrics inherently exhibit good affinity or absorption characteristics for only specific liquids. For example, polyolefin nonwoven webs have heretofore been used to absorb oil or hydrocarbon based liquids. In this regard, polyolefin nonwoven wipes are inherently oleophillic and hydrophobic. Thus, polyolefin nonwoven fabrics need to be treated in some manner in order to impart good wetting characteristics or absorbency for water or aqueous solutions or emulsions. As an example, exemplary wetting agents that can be melt-processed within one of the segments in order to impart improved wettability to the fiber include, but are not limited to, ethoxylated silicone surfactants, ethoxylated hydrocarbon surfactants, ethoxylated fluorocarbon surfactants and so forth. In addition, exemplary chemistries useful in making melt-processed thermoplastic fibers more hydrophilic are described in US Patent Nos. 3,973,068 and 4,070,218 to Weber et al., and US Patent No. 5,696,191 to Nohr et al.; the entire contents of the aforesaid references are incorporated herein by reference.

In a further aspect, it is often desirable to increase the barrier properties or repellency characteristics of a fabric for a particular liquid. As a specific example, it is often desirable in infection control products and medical apparel to provide a fabric that has good barrier or repellency properties for both water and alcohol. In this regard, the ability of thermoplastic fibers to better repel alcohol can be imparted by mixing a chemical composition having the desired repellency characteristics with the thermoplastic polymer resin prior to extrusion and thereafter melt-processing the mixture into one or more of the segments. The active agent migrates to the surface of the polymeric component thereby modifying the surface properties of the same. In addition, it is believed that the distance

or gap between components exposed on the outer surface of the fiber containing significant levels of active agent is sufficiently small to allow the active agent to, in effect, modify the functional properties of the entire fiber and thereby obtain a fabric having the desired properties. Chemical compositions suitable for use in melt-extrusion processes and that improve alcohol repellency include, but are not limited to, fluorochemicals. Exemplary melt-processable liquid repellency agents include those available from DuPont under the trade name ZONYL fluorochemicals and also those available from 3M under the trade designation FX-1801. Various active agents suitable for imparting alcohol repellency to thermoplastic fibers are described in US Patent 5,145,727 to Potts et al., US Patent No. 4,855,360 to Duchesne et al., US Patent No. 4,863,983 to Johnson et al., US Patent No. 5,798,402 to Fitzgerald et al., US Patent No. 5,459,188 and US Patent No. 5,025,052; the entire contents of the aforesaid references are incorporated herein by reference. In addition to alcohol repellency, chemical compositions can be used to similarly improve the repellency or barrier properties for other low surface tension liquids.

The active agent desirably comprises less than about 5% of the entire multicomponent fiber and more desirably comprises between about 0.1% and about 3% of the entire multicomponent fiber and still more desirably between about 0.2% and about 2% of the entire multicomponent fiber. In processing the active agent within one or more components, the active agent and polymer are desirably extruded in a mixture wherein the active agent comprises between about 0.1% and about 5% by weight extrudate and still more desirably comprises between about 0.2% and about 1% of the extrudate. In a further aspect, fabrics having good alcohol repellency can be provided wherein the multicomponent fibers comprise less than 0.8%, by weight, liquid repellency agent and still more desirably comprise about 0.6% or less liquid repellency agent.

Additional materials, which are compatible with and which do not substantially degrade the performance of the particular active agent, can optionally be added to and extruded with one or more of the polymeric components. As an example, one or more of the individual components of the multicomponent fiber can optionally include additional surfactants, dyes, stabilizers, pigments, fragrances, and so forth.

The fabrics of the present invention desirably have a basis weight between about 7 g/m^2 and about 340 g/m^2 and still more desirably have a basis weight between about 14 g/m^2 and about 68 g/m^2. In a further aspect, the fabrics can have an alcohol repellency rating of at least 30 and desirably have an alcohol repellency rating of at least about 50 and even more desirably an alcohol repellency rating of at least about 65. As a particular example, a multicomponent meltblown fabric can be provided having a basis weight between about 14 g/m^2 and about 50 g/m^2 and alcohol repellency rating over 50.

The fabrics of the present invention can be used alone or as part of a multilayer structure. As an example and in reference to FIG. 4, a multilayer nonwoven laminate 20 is provided comprising a multicomponent meltblown fiber web 22 laminated to sheet-like layer or fabric 24 such as, for example, a nonwoven web of spunbond fibers. In a particular aspect and still in reference to FIG. 4, the multilayer laminate can comprise a three layer laminate 20 such as, for example, an intermediate layer of multicomponent meltblown fibers 22 between a first spunbond fiber web 24 and a second spunbond fiber web 26 to form a spunbond/meltblown/spunbond (SMS) nonwoven web laminate. In this regard, the individual layers can be attached to one another by one or more means known in the art such as, for example, by thermal, ultrasonic and/or adhesively bonding the layers together. As an example, individual layers can be pattern bonded such as, for example, by point bonding. As used herein "point bonding" means bonding one or more layers of fabric at numerous small, discrete bond points such as, for example, bond points 28 depicted in FIG. 4. As a specific example, thermal point bonding generally involves passing one or more layers to be bonded between heated rolls such as, for example, an engraved or patterned roll and a second roll. The engraved roll is patterned in some way so that the fabric is not bonded over its entire surface, and the second roll can either be flat or patterned. As a result, various patterns for engraved rolls have been developed for functional as well as aesthetic reasons. Desirably the multilayer laminates are pattern bonded such that the bonded area comprises less than 50% of the fabric surface area and still more desirably the bonded area comprises between about 5% and about 30% of the fabric surface area. Exemplary bond patterns and/or bonding processes suitable for use with the present invention include, but are not limited to, those described in US Patent No. 4,374,888 to Bornslaeger, US Patent No. 3,855,046 to Hansen et al., US Patent No. 5,635,134 to Bourne et al. and PCT Application US94/03412 (publication no. WO95/09261).

The fabrics of the present invention are well suited for use in a variety of end uses and applications including, but not limited to, use as or in medical fabrics, personal care products, protective fabrics, sorbents, wipes and so forth. In this regard, the fabrics of the present invention are particularly well suited for use in surgical gowns, surgical drapes, tarpaulins and other liquid barrier fabrics.

Tests

Alcohol Repellency Rating: The alcohol repellency rating can be determined by placing drops of the isopropyl alcohol (IPA)/water solutions on the fabric surface. The solutions can contain increments of 5% by volume IPA in water, from 20% to 100% IPA. As the level of

IPA in the solution is increased, the surface tension is decreased. Thus, solutions having higher levels of IPA are more difficult to repel. Eight drops of each solution are placed along the cross-machine direction of the fabrics and after five minutes the repellency rating is obtained. The repellency rating is the solution with the highest % IPA that, by observing the back of the fabric, is not drawn into and passed through the fabric. A fabric is considered to have failed a particular level when one of the drops wets out.

Examples

The materials referenced in the following examples were made using the meltblowing process. Both the monocomponent and multicomponent fibers have a solid round cross-section. With regard to the multicomponent fibers, the polymeric compounds were melted and the respective molten polymer streams were separately directed through the die apparatus until just prior to the die capillary entrance. The molten polymer streams were directed into the die in order to form fibers having an A/B/A cross-sectional configuration similar to that depicted in FIG. 1 and wherein the B component comprised approximately 50% by volume of the fiber cross-section. The melt temperature was 282°C and the primary draw air was also at 282°C. The active agent for imparting alcohol repellency was pre-compounded with the resins prior to melt-processing. For purposes of the data described herein below, the alcohol repellency rating tests was performed using only 10% increments (20%, 30%, 40%, etc.).

Example 1: A multicomponent fiber meltblown nonwoven web was formed having a basis weight of about 17 g/m^2 and an average fiber diameter of from 3-5 micrometers. The A component comprised a mixture of 1% by weight of an alcohol repellency agent (a fluorochemical available under the trade designation FX-1801 from 3M), 8.3% polybutylene (DP-8911 available from Montell) and 90.7% polypropylene (3746G available from Exxon Chemical Company). The B component comprised about 15% polybutylene (DP-8911 available from Montell) and about 85% polypropylene (3746G available from Exxon Chemical Company).

Example 2: A multicomponent fiber meltblown nonwoven web was formed having a basis weight of 17 g/m^2 and an average fiber diameter of 3-5 micrometers. The A component comprised a mixture of 1% by weight of an alcohol repellency agent (a fluorochemical available under the trade designation FX-1801 from 3M), 2.1% pigment, 8.3% polybutylene (DP-8911 available from Montell) and 88.6% polypropylene (3746G available from Exxon Chemical Company). The B component comprised 0.5% by weight of a

fluorochemical (FX-1801 available from 3M), 2.1% pigment, 8.3% polybutylene (DP-8911 available from Montell) and 89.1% polypropylene (3746G available from Exxon Chemical Company).

Example 3: A multicomponent fiber meltblown nonwoven web was formed having a basis weight of 17 g/m^2 and an average fiber diameter of 3-5 micrometers. The A component comprised a mixture of 1% by weight of an alcohol repellency agent (a fluorochemical available under the trade designation FX-1801 from 3M), 2.1% pigment, 8.3% polybutylene (DP-8911 available from Montell) and 88.6% polypropylene (3746G available from Exxon Chemical Company). The B component comprised 0.25% by weight of a fluorochemical (FX-1801 available from 3M), 2.1% pigment, 8.3% polybutylene (DP-8911 available from Montell) and 89.3% polypropylene (3746G available from Exxon Chemical Company).

Example 4: A multicomponent fiber meltblown nonwoven web was formed having a basis weight of 17 g/m^2 and an average fiber diameter of 3-5 micrometers. The A component comprised a mixture of 1% by weight of an alcohol repellency agent (a fluorochemical available under the trade designation FX-1801 from 3M), 2.1% pigment, 8.3% polybutylene (DP-8911 available from Exxon Chemical Company) and 88.6% polypropylene (3746G available from Exxon Chemical Company). The B component comprised 2.1% pigment, 8.3% polybutylene (DP-8911 available from Montell) and 89.6% polypropylene (3746G available from Exxon Chemical company).

Comparative Example 1: A monocomponent fiber meltblown nonwoven web was formed having a basis weight of 17 g/m^2 and an average fiber diameter of 3-5 micrometers. The fibers comprised 2.1% pigment, 7.9% polybutylene (DP-8911 available from Montell) and 90% polypropylene (3746G available from Exxon Chemical Company).

Comparative Example 2: A monocomponent fiber meltblown nonwoven web was formed having a basis weight of 17 g/m^2 and an average fiber diameter of 3-5 micrometers. The fibers comprised 1% by weight alcohol repellency agent (a fluorochemical available under the trade designation FX-1801 from 3M), 2.1% pigment, 7.9% polybutylene (DP-8911 available from Montell) and 89% polypropylene (3746G available from Exxon Chemical Company).

The nonwoven webs described in the aforesaid examples were evaluated and the results are set forth in Table 1.

Example	Total Fiber FC Level (Target)	R pellency Rating		
		O Hr.	24 Hr.	X days
Comp. 1	0	20	20	20 (x = 8)
Comp. 2	1.0%	70	70	70 (x = 43)
Ex 1	0.5%	70	70	70 (x=90)
Ex 2	0.75%	70	70	70 (x=28)
Ex 3	0.63%	70	60	70 (x=28)
Ex 4	0.5%	60	70	70 (x=28)

The examples above indicate that a fabric can be obtained having a low level of active agent that provides excellent liquid repellency despite having little or no active agent within all of the components exposed upon the outer surface of the fibers. Further, the alcohol repellency rating is comparable to fabrics comprising fibers having active agent distributed within all components forming the outer surface of the fiber.

While various patents and other reference materials have been incorporated herein by reference, to the extent there is any inconsistency between incorporated material and that of the written specification, the written specification shall control. In addition, while the invention has been described in detail with respect to specific embodiments thereof, it will be apparent to those skilled in the art that various alterations, modifications and other changes may be made to the invention without departing from the spirit and scope of the present invention. It is therefore intended that the claims cover or encompass all such modifications, alterations and/or changes.

What is claimed is:

1. A multicomponent fiber nonwoven web having modified surface properties comprising:

a web of multicomponent thermoplastic polymer fibers having a cross-section, a length, and a peripheral surface, said multicomponent fibers having at least one component A and at least one component B arranged in substantially distinct zones across the fiber cross-section and extending substantially continuously along the length of the fibers, said components A and B each having exposed portions forming the outer surface of the multicomponent fibers and wherein said component A comprises at least about 25% of the outer surface of the multicomponent fibers;

said component A comprises a thermoplastic polymer and an active agent and further has active agent upon the exposed portion forming part of the outer surface of the multicomponent fibers; and

said component B comprises a thermoplastic polymer and contains from 100% to 50% by weight less active agent than said component A.

2. The multicomponent fiber nonwoven web of claim 1 wherein said multicomponent fibers have an average denier less than 4.

3. The multicomponent fiber nonwoven web of claim 2 wherein said component A comprises less than 5% by weight active agent.

4. The multicomponent fiber nonwoven web of claim 2 wherein the component B comprises at least 95% less active agent than said component A.

5. The multicomponent fiber nonwoven web of claim 2 wherein said active agent is selected from the group consisting of wetting agents and liquid repellency agents and further wherein said component A comprises at least about 50% of the outer surface of the multicomponent fibers.

6. The multicomponent fiber nonwoven web of claim 5 wherein said component A comprises less than 5% by weight active agent and further wherein said component B comprises from 75% to 100% less active agent than within said component A.

7. The multicomponent fiber nonwoven web of claim 5 wherein said multicomponent fibers have an average fiber diameter less than about 10 micrometers and an average denier less than 1.

8. The multicomponent fiber nonwoven web of claim 5 wherein said active agent comprises a wetting agent.

9. The multicomponent fiber nonwoven web of claim 8 wherein said nonwoven web comprises olefin polymer components and has a basis weight between about 17 g/m^2 and about 340 g/m^2.

10. The multicomponent fiber nonwoven web of claim 1 wherein said multicomponent fibers have an average denier less than about 1 and further wherein each discrete exposed portion of said component B comprises less than 35% of the peripheral surface of the multicomponent fiber.

11. The multicomponent fiber nonwoven web of claim 10 wherein said active agent comprises a liquid repellency agent.

12. The multicomponent fiber nonwoven web of claim 11 wherein said component A comprises at least two discrete components and are separated by said component B.

13. The multicomponent fiber nonwoven web of claim 11 wherein said active agent comprises a fluorochemical.

14. The multicomponent fiber nonwoven web 12 wherein said nonwoven web comprises a meltblown fiber web.

15. The multicomponent fiber nonwoven web of claim 12 wherein said fibers have an average fiber diameter less than about 5 micrometers.

16. The multicomponent fiber nonwoven web of 15 wherein said component B comprises at least about 45%, by volume, of the fiber cross-section.

17. The multicomponent fiber nonwoven web of 15 wherein said active agent comprises an alcohol repellency agent and further wherein multicomponent fiber nonwoven web has an alcohol repellency rating of at least about 50.

18. The multicomponent fiber nonwoven web of claim 3 wherein said active agent comprises a liquid repellency agent and further wherein the multicomponent fibers have an average fiber diameter less than about 5 micrometers and further wherein the exposed portions of said component B collectively comprise less than about 50% of the outer surface of the multicomponent fiber.

19. The multicomponent fiber nonwoven web of claim 18 wherein said active agent comprises less than 0.75%, by weight, of said multicomponent fibers and further wherein said nonwoven web has a basis weight less than 50 g/m^2 and an alcohol repellency rating of at least 65.

20. The multicomponent fiber nonwoven web of claim 19 wherein said active agent comprises a fluorochemical.

1/1

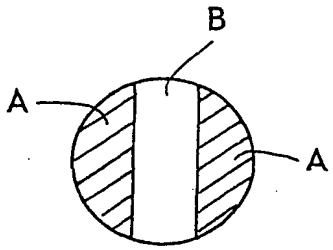

FIG. 1

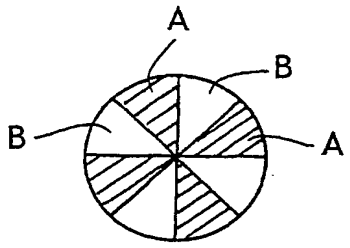

FIG. 2

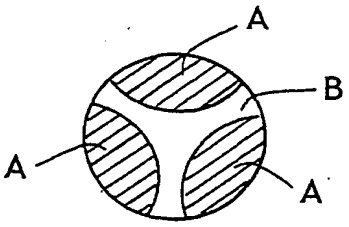

FIG. 3

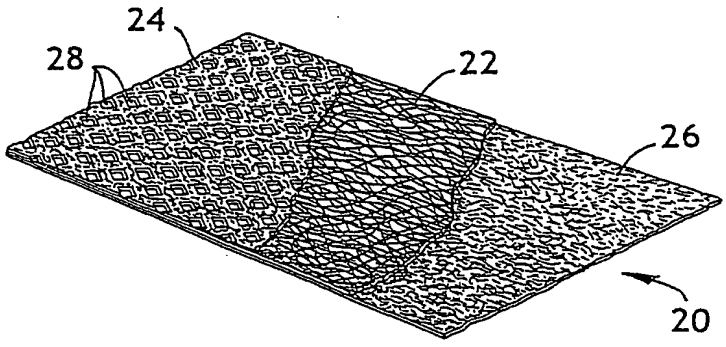

FIG. 4

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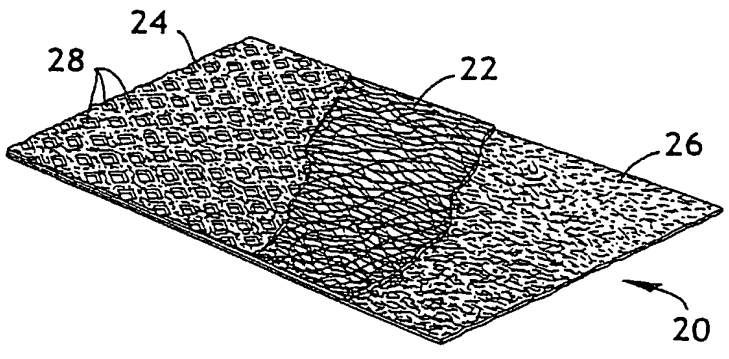
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: FABRICS HAVING MODIFIED SURFACE PROPERTIES



(57) Abstract: Multicomponent fiber nonwoven webs having excellent liquid handling and/or repellency properties are described wherein the multicomponent thermoplastic polymer fibers have exposed first and second components that form the outer surface of the multicomponent fibers and that extend substantially continuously along the length of the fibers. The first component comprises a thermoplastic polymer and an active agent, such as a liquid repellency agent, and the second component comprises a thermoplastic polymer and contains from 100% to 50% by weight less active agent than the first component.

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D04H D01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 534 339 A (STOKES TY J) 9 July 1996 (1996-07-09) column 3, line 32 -column 6, line 34	1,5,8,14
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☐ Further documents are listed in the continuation of box C.

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Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	V Beurden-Hopkins, S

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